Video Analytics for Understanding Animal Behavior

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Overview

- Improve pose estimation accuracy for antelope images from motion-triggered camera traps in Senegal
- We utilized the existing dataset AP-10k for base understanding
- Results on 100 consistent antelope images showed that including taxonomically and visually similar animals during training improves model generalization
- A custom keypoint labeling scheme was developed to enhance labeling consistency across low-quality images

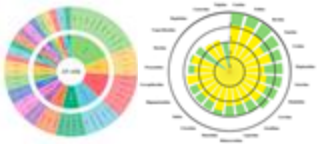
Training Data

Does a model perform better when it's trained on similar species?

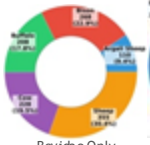
Experiment Setup:

- Testing data: 100 antelope images
- Training data:
  - Bovidae: Closest taxonomic family
  - Cervidae contribution: Visually similar species (deer and moose)
  - Control: All species from AP-10k, with number of images reduced to match the previous two subsets

Examples of Mammals in Bovidae Family
Image credit to Wikipedia



AP 10k Full Dataset
Figure adapted from (Yuet al., 2021)



Bovidae Only Dataset

Bovidae & Cervidae Dataset

METRIC	BOVIDAE	BOVIDAE + CERVIDAE	FULL AP-10K
Avg. Precision	0.724	**0.774**	0.730

Ground Truth Labels | Bovidae Model | Bovidae + Cervidae Model | Full AP-10k Model

(Images from AP10k)

Remarks:

- Training exclusively with Bovidae images does not improve accuracy
- However, including Cervidae images considerably improves performance on antelopes
- Visually similar training set (Cervidae) yields better network than taxonomically similar training set (Bovidae)

Extending To Our Data

Objective:

- Improve pose estimation model accuracy on our in-the-wild images from Senegal

Challenge:

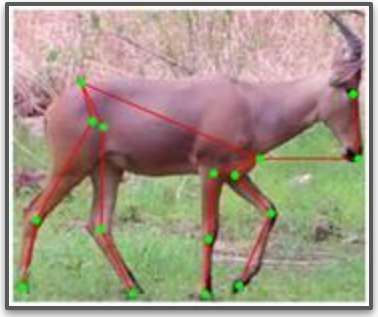
- AP10k dataset does not have a publicly available labeling scheme and many of their keypoints were inconsistent
- Keypoints are inherently difficult to define precisely

Approach:

- Develop a custom labeling scheme to ensure both consistency across our labelers, and robustness for every keypoint
- Validated consistency of the keypoint definitions through trials with our labelers, and iteratively improved the definitions based on feedback

Example Definition

Visualized keypoint labeling



Next Steps

New Training Datasets:

- Develop a robust species similarity metric based on average species limb ratios, muscularity, and range-of-motion
- Evaluate the performance of keypoint estimation model trained on visually vs. taxonomically similar species

Extending Our Data:

- Annotate a dataset of camera trap antelope images with custom scheme
- Fine-tune and test our keypoint estimation model on different subsets of our dataset